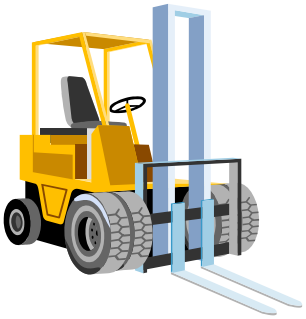
Missouri Department of Health and Senior Services

Hazardous Substances Emergency Events Surveillance (HSEES) Program

An analysis of acute releases of chemicals involved in Improper Loading / Unloading and in Forklift Punctures

2000-2002

December 2004



EXECUTIVE SUMMARY

Since 1990, the federal Agency for Toxic Substances and Disease Registry (ATSDR) has maintained an active, state-based Hazardous Substances Emergency Events Surveillance (HSEES) system to describe the actual and potential public health consequences associated with actual and threatened releases of hazardous substances. Since 1994, the Missouri Department of Health and Senior Services (DHSS) has participated in this surveillance system.

During 2000-2002 there were a total of 1060 events meeting the HSEES case definition (see Methods), including both actual and threatened releases. Improper loading/unloading and forklift punctures comprised 251 (23.7%) of these events. Of the 251, 249 events involved actual chemical releases. Almost $135,000 in damages and lost product were incurred as a result of improper loading, and over $83,000 in damages and lost product were incurred as a result of forklift puncture *(U.S. Department of Transportation, Hazardous Materials Information System, 2000-2002 Missouri data).* Employee work time lost due to injuries and subsequent cleanup activities adds to the cost of these chemical releases.

This report summarizes the characteristics of chemical releases involving improper loading/unloading and forklift punctures that were reported to HSEES during calendar years 2000-2002. The report will be used to increase the awareness of the number and types of these events. It also recommends improved procedures and trainings to reduce the number of events in the future. The type of data collected included general information on the event, substance(s) released, number of victims, number and types of adverse health effects experienced by victims, and number of evacuations. The U.S. Department of Transportation's Hazardous Material Information System (HMIS) data is the source used by the Missouri HSEES Program to obtain notification and information regarding improper loading/unloading and forklift puncture transportation-related events.

From January 2000 to December 2002 a total of 163 events related to improper loading/unloading of chemicals were reported to the Missouri HSEES program; 17 (10.4%) of these events occurred at fixed facilities and 146 (89.6%) met the criteria of transportation events. Human error is the primary factor in acute chemical releases involving transportation. The most commonly reported categories of substances released were other (substances that do not fit into any other category), acids and bases. During this period 4 events (2.4%) involved 7 victims. The adverse health effects experienced by the victims were respiratory, gastrointestinal problems and dizziness or other central nervous system (CNS) symptoms. All victims were treated at a hospital facility and released. Evacuations were required in 4 events.

Of the 86 events related to forklift punctures, 10 (11.6%) forklift puncture events occurred at fixed facilities and 76 (88.4%) met the criteria of transportation events. The most commonly reported categories of substances released in these events were other, volatile organic compounds (VOC) and paints and dyes. Two events (2.3%) involved 2 victims. The adverse health effects experienced by both victims were respiratory problems and eye irritation that were treated at a hospital facility. The victims were then released. No evacuations were required due to forklift events.

HAZARDOUS SUBSTANCES EMERGENCY EVENTS SURVEILLANCE

Acute releases of chemicals involved in Improper Loading /Unloading and in Forklift Punctures

INTRODUCTION

The four goals of the Missouri HSEES program are to:

- Describe the distribution and characteristics of hazardous substances emergencies.
- Describe the morbidity and mortality experienced by employees, responders, and the general public as a result of hazardous substances releases.
- Identify risk factors associated with the morbidity and mortality.
- Identify strategies that might reduce future morbidity and mortality resulting from the release of hazardous substances.

This report summarizes the characteristics of releases occurring from improper loading/unloading and to forklift punctures, and their associated public health consequences during 2000-2002.

METHODS

Participating state health departments began collecting data on hazardous substances emergencies meeting the following case definition:

- An uncontrolled or illegal release or threatened release of one or more hazardous substances, **and**
- The substances that are actually released or threatened to be released include ALL hazardous substances except petroleum (Note: The Petroleum Exclusion clause of the CERCLA legislation excludes any forms of petroleum that have not been refined to the point of becoming single-chemical products such as pure xylene.), **and**
- The quantity of the hazardous substances which are released, or are threatened to be released, need (or would need) to be removed, cleaned up, or neutralized according to federal, state, or local law; **or**
- There is only a threatened release of hazardous substances, but this threat leads to a public health action (e.g., an evacuation) that can potentially impact on the health of employees, responders, or the general public. This action makes the event eligible for inclusion into the surveillance system if the other three criteria are also met, even though the hazardous substances are not released.

In 1999, the Missouri HSEES program adopted ATSDR's recommendation to report all hazardous substance releases in which the quantity released was one gallon/ten pounds or more. For substances with an Environmental Protection Agency (EPA) reportable quantity of one pound or less, all releases are reported regardless of the quantity.

The U.S. Department of Transportation HMIS data was the notification source for improper loading/unloading and forklift puncture transportation-related events in Missouri.

Information collected for each event included:

- Date and time of occurrence
- Causal factors
- Event type (transportation or fixed facility)
- Substance(s) released
  - Substance name
  - Chemical form
  - Type of release (spill, air emission, fire, explosion)
  - Quantity released
- Victim(s)
  - Population group
  - Type of injury sustained
  - Severity
  - Demographics
  - Personnel protective equipment (PPE) worn
  - Distance from the release
- Evacuations
- Numbers of persons potentially affected (based on census data and working population)
- Public health activities initiated (environmental sampling, health advisory, health investigation)
- Response plans followed

Events captured by HSEES that are classified as transportation-related events involve hazardous materials released during transport by surface, air, or water. Fixed facility events are those that occur outdoors or inside a building on the premises of the facility or site. During loading and unloading, an event is transportation if the release occurs before all of the material has been unloaded from the vehicle. An event is fixed facility if the release occurs before all of the material has been totally loaded onto the vehicle.

Victims are defined as individuals with symptoms or injuries (including death) that result from the event. Victims who receive more than one type of injury are counted once in each applicable type of injury.

Substances are grouped into 16 categories which include acids, ammonia, bases, chlorine, other inorganic substances, paints & dyes, pesticides, formulations, hetero-organics, polymers, polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), mixtures (substances from different categories that were mixed prior to the release) and other (substances that are not classified into any other category). Substances were considered to be released, threatened to be released, or some threatened and some released.

INTERESTING EVENTS

Of the 249 events involving actual chemical releases during 2000-2002, the details of 6 events are described below.

1. Due to improper loading, a pallet fell over causing calcium hypochlorite to spill on the concrete warehouse floor. It then reacted with moisture and debris creating heat, which resulted in a fire. Four firefighters suffered respiratory problems as a result of the incident. They received medical treatment and were all treated and released.

2. The driver of a transport truck noticed an odor when he stopped to make a delivery at a dealership. The area was evacuated due to the potential danger of acid and sodium hydroxide chemicals being mixed. Four containers inside the truck were leaking due to improper loading. The highway was closed and the building evacuated for four hours.

3. A car stopped suddenly in front of a delivery truck requiring the driver to brake sharply to avoid hitting the car. The load in the truck shifted inside the trailer. The driver pulled off the road and realized that acid had begun leaking out of the floor of the trailer onto the ground. Two nearby businesses were evacuated, and officials from ten agencies responded to the incident. All responders working to remediate the spill were decontaminated and their suits and other materials were burned. The highway was closed and remained closed for five hours.

4. A delivery driver mistakenly loaded chlorine into an incorrect tank which was designed to contain sulfuric acid. The tank could not properly contain the chlorine and resulted in a chlorine release. An employee assisting with the unloading suffered respiratory irritation and was treated and released from a medical facility.

5. Due to improper loading, a substance was leaking in a trailer during unloading. An employee went into the trailer to apply absorbent and was affected by fumes of sodium hypochlorite. The employee experienced respiratory problems and was treated at a medical facility and then released.

6. An employee punctured a drum with a forklift causing a vapor release of methylene chloride. The employee inhaled the fumes and was sent to hospital by ambulance. The ambulance was contaminated by the methylene chloride. An area of the hospital was cordoned off and restricted to necessary traffic only until all decontamination activities were completed.

RESULTS

A total of 1060 HSEES events, including fixed facility and transportation events occurred during 2000-2002. Of these, 251 events involved improper loading/unloading and forklift puncture. Two of these events were threatened, but no actual hazardous substance release actually occurred. The frequency of all other 249 events with actual release by cause of event, year and type of event is displayed in Table 1.

Table 1 – Number of events involving improper loading/unloading and forklift puncture, by year, cause of release and type of event, Hazardous Substances Emergency Events Surveillance, Missouri, 2000-2002*

Year	Cause of Release								Total
	Improper loading/unloading				Forklift Puncture				
	**F	**T	No. of events	%	**F	**T	No. of events	%	No. of events
2000	9	43	52	31.9%	8	26	34	39.5%	86
2001	3	45	48	29.4%	2	21	23	26.7%	71
2002	5	58	63	38.7%	0	29	29	33.7%	92
Total	17	146	163	100.0%	10	76	86	99.9%	249*

* Two threatened events were excluded ** F = Fixed, T = Transportation

Note: The totals do not equal 100% due to rounding.

Table 2, Figure 1 and Figure 2 display the frequency of events by county and cause of release. Counties with the higher number of events such as Boone (10), Greene (40), Jackson (47), St. Charles (31) and St. Louis City (65) have major transportation terminals which account for the increased number of releases in those areas.

Table 2 – Events involving improper loading/unloading and forklift puncture by county, Hazardous Substances Emergency Events Surveillance, Missouri, 2000-2002*

County	Cause of release		Total No. of events
	Improper loading/unloading No. of events	**Forklift Puncture** No. of events	
Atchison	1	0	1
Audrain	0	2	2
Barry	1	0	1
Boone	5	5	10
Buchanan	2	0	2
Butler	1	0	1
Callaway	1	0	1
Camden	1	0	1
Cape Girardeau	1	0	1
Cass	2	0	2
Christian	1	0	1
Clay	6	1	7
Cooper	3	0	3
Franklin	1	0	1
Greene	25	15	40
Grundy	1	0	1
Jackson	30	17	47
Jasper	2	2	4
Jefferson	1	0	1
Maries	1	0	1
New Madrid	3	1	4
Nodaway	1	0	1
Pemiscot	2	0	2
Platte	1	0	1
Ralls	1	0	1
Ray	1	0	1
Scott	3	1	4
St. Charles	24	7	31
St. Louis	4	4	8
St. Louis City	34	31	65
Stoddard	1	0	1
Taney	1	0	1
Warren	1	0	1
TOTAL:	**163**	**86**	**249***

*Two threatened events were excluded

Figure 1 – Geographic distribution of events involving improper loading/unloading by county, Hazardous Substances Emergency Events Surveillance, Missouri, 2000-2002*

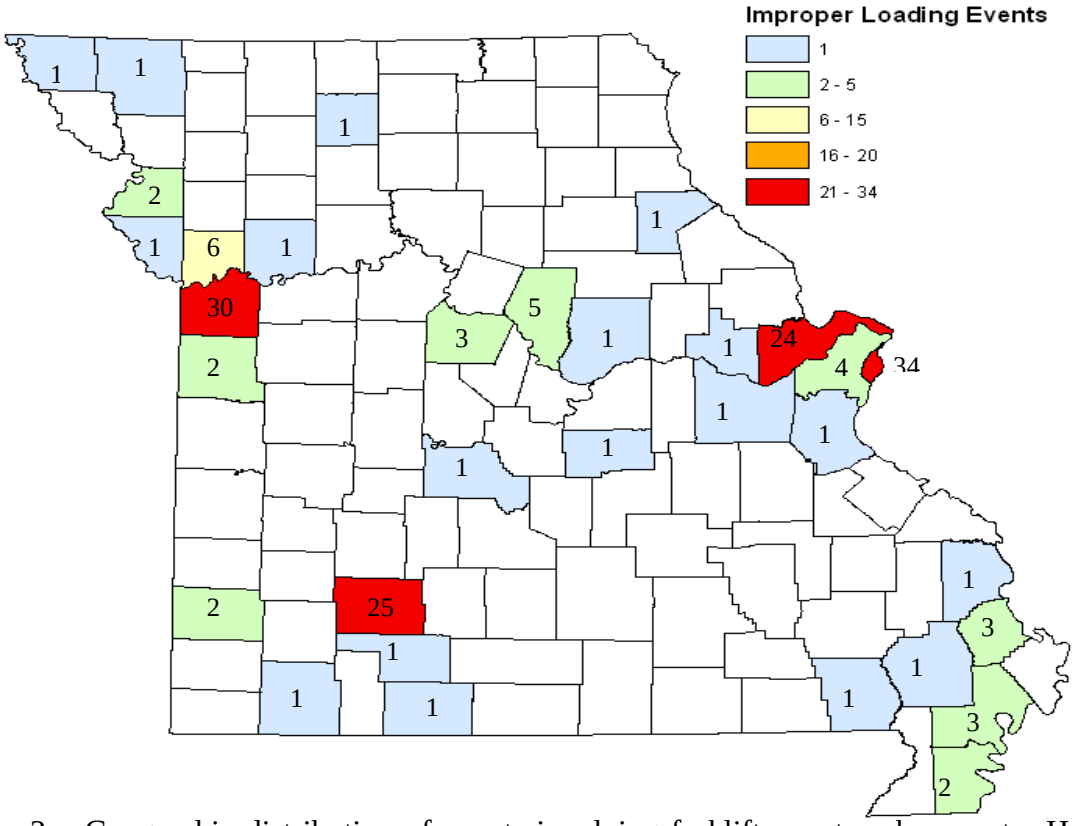
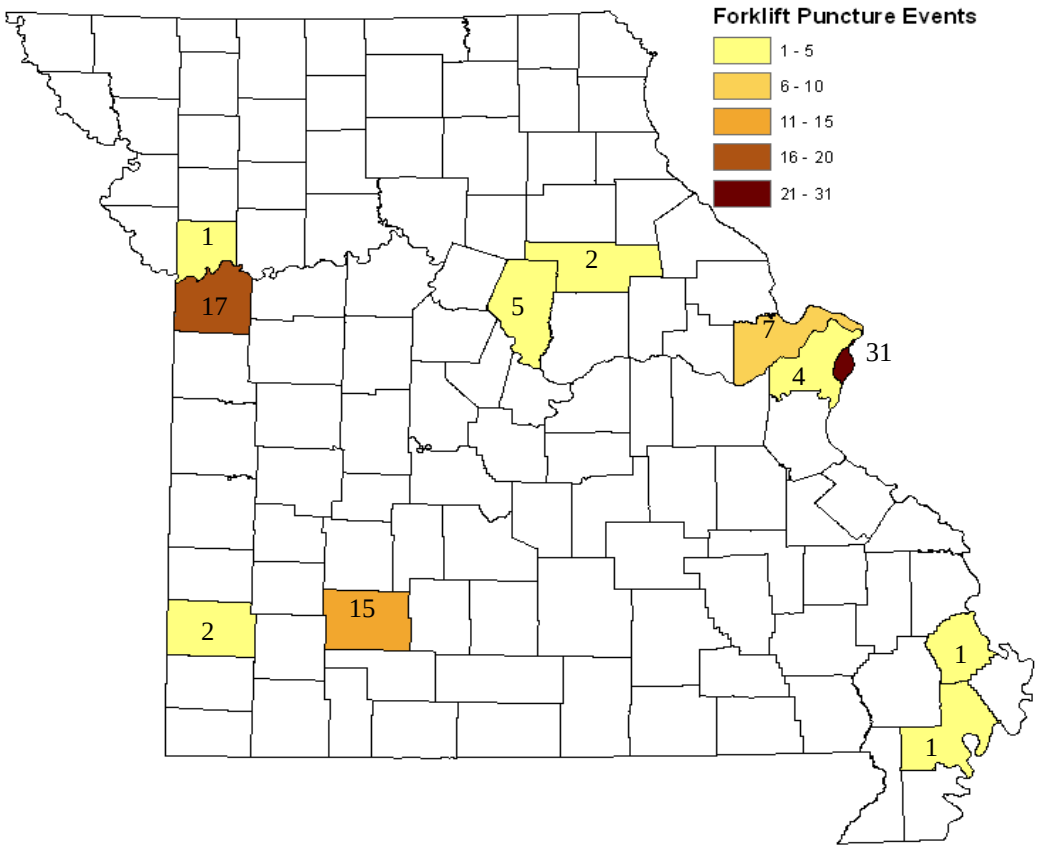


Figure 2 – Geographic distribution of events involving forklift puncture by county, Hazardous Substances Emergency Events Surveillance, Missouri, 2000-2002*



SUBSTANCES

Human error is the primary factor in acute chemical releases involving transportation. A total of 252 substances were actually released in 249 events. The number of substances released was greater than the number of events, since all substances released are included. Of the 246 events in which one substance was released, 162 (99.4%) were improper loading/unloading events and 84 (95.5%) were related to forklift punctures. The three remaining events involved the release of multiple substances. Most substances were released during spills (n=244, 96.8%). The remaining substances were released during air emissions (n=2, 0.8%), or a combination of two types of release (n=6, 2.4%).

Improper loading events involved the release of 164 substances. Forklift puncture-related events involved the release of 88 substances. Table 4 describes the five most frequently released substances in improper loading/unloading and in forklift puncture events. Three of these substances are common to both types of event.

Table 4 - The 5 most frequently released substances in improper loading/unloading and in forklift puncture events, Hazardous Substances Emergency Events Surveillance, Missouri, 2000-2002*

Standardized Substance Name	Frequency	
	Improper loading/unloading	Forklift Punctures
Resin Solution	10	12
Phosphoric Acid	9	0
Adhesive NOS	8	5
Sodium Hydroxide	8	0
Paint or Coating NOS	7	12
Potassium Hydroxide NOS	0	4
Xylene	0	3
Total	42	36

Of the 16 categories into which HSEES substances were grouped, the categories of substances most commonly released in improper loading/unloading events were other (n=40, 24.5%), acids (n=28, 17.1%), bases (n=14, 8.5%), and paints & dyes (n=14, 8.5%). In forklift puncture-related events the most frequently released chemicals were categorized as other (n=22, 25%), volatile organic compounds (VOCs) (n=22, 25%) and paints & dyes (n=14, 8.5%) (Table 5).

Table 5 - Number of substances by substance category and cause of release, Hazardous Substances Emergency Events Surveillance, Missouri, 2000-2002

Substance category	Type of event			
	Improper loading/unloading		Forklift Puncture	
	No. of substances	(%)	No. of substances	(%)
Acids	28	17.1%	7	8.0%
Ammonia	0	0.0%	1	1.1%
Bases	14	8.5%	6	6.8%
Chlorine	2	1.2%	0	0.0%
Other inorganic substances	12	7.3%	5	5.7%
Paints & dyes	14	8.5%	14	15.9%
Pesticides	7	4.3%	3	3.4%
Polychlorinated biphenyls	0	0.0%	0	0.0%
Volatile organic compounds	31	18.9%	22	25.0%
*Other	40	24.4%	22	25.0%
**Mixture	9	5.5%	1	1.1%
Formulations	0	0.0%	0	0.0%
Hetero-Organics	2	1.2%	1	1.1%
Hydrocarbons	0	0.0%	0	0.0%
Oxy-Organics	2	1.2%	3	3.4%
Polymers	2	1.2%	3	3.4%
+Unknown	1	0.6%	0	0.0%
++Total	164	99.9%	88	99.9%

*__Other__ = Substances that do not fit into any other category. Also includes radioactive substances and substances whose primary purpose is pharmaceutical or biological.

** __Mixtures__ = substances from different categories mixed prior to release

+A category has not been assigned for the chemical 4-(N-Ethyl-N-2-methanesulfonylaminoethyl)

++The totals do not equal 100% due to rounding

NOTE: Total exceeds total number of events because events in which more than one substance was released were counted more than once.

VICTIMS

A total of nine victims were involved in 6 improper loading/unloading and in forklift puncture events. The characteristics related to victims in these events are displayed in Table 6.

Table 6 - Number of events, events with victims, and related adverse health effects of victims, by year and by cause of event, Hazardous Substances Emergency Events Surveillance, Missouri, 2000-2002

Year	Number of Events	Events with victims	Number of victims			Adverse Health Affect	Population Group	
			Improper loading/ unloading	Forklift	Total		Employee	Firefighter
2000	86	1	4	0	4	Respiratory	0	4
2001	71	2	1	0	1	Respiratory	1	0
			0	1	1	Eye Irritation	1	0
2002	92	3	1	0	1	Dizziness or other CNS symptoms	1	0
			1	0	1	Gastrointestinal problems	1	0
			0	1	1	Respiratory	1	0
Totals	**249**	**6**	7	2	9		5	4

Respiratory irritation was the most commonly observed adverse health effect. The population groups affected were employees (56%, n=5) and first responders (44%, n=4).

EVACUATIONS

Evacuations were ordered in 4 events (1.6%). The number of persons evacuated was known for 3 of the 4 events and the median number of persons evacuated was 20 (range: 9-35). The length of evacuation was known for all events and the median length of evacuation was 3.5 hours (range: 3-7.5).

RECOMMENDATIONS

Every day hundreds of loads of hazardous materials are handled in the state of Missouri or cross Missouri roads and highways. This creates the potential for releases, injuries and evacuations. Because human error is the primary factor in chemical releases involving loading/unloading and in forklift punctures, it is recommended that those persons responsible for handling hazardous materials be adequately trained and informed about the chemicals they handle. In addition, to reduce exposure to the chemicals, they need to be knowledgeable of the protective clothing appropriate for the circumstances of the release. Evacuations and injuries are not limited to the companies responsible for the release but affect the general public and responders as well. Consistently ensuring that all employees have effective on-going training and safe work practices may reduce the number of events involving chemical releases. Employees, responders and the general public should be provided with the knowledge, awareness and understanding of the risks associated with unsafe handling and driving practices. In addition, safety measures should be in place for those who have the potential for being affected by these types of releases.

In Missouri, areas that contain major transportation terminals are at higher risk for hazardous substance releases. The counties with the largest numbers of events in 2002-2004, all of which contain transportation terminals, were Boone (10), Greene (40), Jackson (47), St. Charles (31) and St. Louis City (65). Additional prevention efforts and targeted training to reduce spills and injuries is particularly important in these locations.

All employees operating equipment should receive and be given the opportunity to read the current operator's manuals. Supervisors must review with employees the correct operating procedures prior to use of the equipment. Other suggested methods are the use of visual aids during training, employee evaluations, refresher trainings or issuance of licenses (within the company) to operate powered industrial trucks.

Resources such as the U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) guide can be used by industries in developing a powered industrial operator training program. This guide, along with other information related to powered industrial trucks, can be found on the OSHA website:

Powered Industrial Truck Training Materials:
http://www.osha.gov/dcsp/ote/trng-materials/pit/pit.html

Forklift Information:
http://www.osha.gov/SLTC/poweredindustrialtrucks/index.html

Other Federal Agency Standards:
http://www.osha.gov/SLTC/poweredindustrialtrucks/agency.html

For additional reports, data analyses and information on the Missouri HSEES program, please view our web site at www.dhss.mo.gov/hsees